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Coupled Δ_{47}–Δ_{48} clumped isotope analysis indicates origins of kinetic isotope effects in cultured biogenic marine carbonates

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The elemental and isotopic geochemistry of biominerals can serve as archives of environmental parameters. Biomineralization is a highly-controlled process, often causing mineral chemistry to be out of equilibrium with the ambient environment and potentially impacting their use as paleoenvironmental proxies. Here, we explore multiply-substituted carbonate “clumped” isotope signatures in a suite of biogenic carbonates. Carbonate clumped isotope geochemistry has been used to constrain mineral formation temperatures and previous work has suggested that paired clumped isotope systems in carbonates can be used to identify kinetic effects (Tripati et al., 2015; Guo, 2020). We provide novel insights into the origins of these effects from combined measurements of ^{16}O–^{13}C–^{18}O (Δ_{47}) and ^{18}O–^{12}C–^{18}O (Δ_{48}) isotopologues on a suite of nine marine calcifying organisms, including species from five phyla, grown at a single temperature (25 °C) and a range of *p*CO2 conditions. Preliminary results indicate evidence for kinetic effects in some taxa, and suggests that dual clumped isotope analysis (Δ_{47}–Δ_{48}) may be able to constrain interspecific differences in the underlying processes that lead to clumped isotope disequilibrium in biominerals.